Section 2.4

Sequencing of the Shared Solution

2.4.1 Summary of Approach for Supplemental EIS

The term *sequencing* in this Supplemental EIS refers to the sequence, or order, in which the various major components of the Shared Solution (i.e., mass transit expansion, I-15 reconstruction, and Legacy Parkway) are constructed.

The Final EIS analyzed the following two sequencing scenarios.

- Construct Legacy Parkway prior to reconstructing I-15.
- Reconstruct I-15 prior to constructing Legacy Parkway.

These two scenarios were analyzed primarily to evaluate the ability of the sequencing scenario to provide capacity while deferring other impacts, including direct impacts on wetlands that would result from the construction of Legacy Parkway. In the June 2000 Final EIS, the lead agencies determined that reconstructing I-15 prior to constructing Legacy Parkway was not a practicable alternative because of the unacceptable level of congestion that would result on I-15. The appellate court remand stated that the Legacy Parkway Final EIS failed to consider alternative sequencing of the three major components of the Shared Solution (mass transit, I-15 improvements, and Legacy Parkway). Specifically, the court posed the following questions.[1]

- Is the [lead agencies'] conclusion [in the Final EIS] that it is not reasonable to reconstruct I-15 before building Legacy Parkway still valid?
- Is it reasonable to delay construction of Legacy Parkway until all or part of the mass transit expansion is in place?
- Can mass transit alleviate the immediacy of need for I-15 [reconstruction] or Legacy Parkway?

The lead agencies used the Supplemental EIS scoping process to gather input on the full range of alternative construction sequencing scenarios that evaluated the timing of mass transit in relation to I-15 and Legacy Parkway, as documented in the Legacy Parkway technical memorandum: *Sequencing of the North Corridor Shared Solution* (sequencing technical memorandum) (HDR Engineering 2004b). In addition to incorporating scoping comments, the approach to the sequencing analysis and the evaluation

[1] These questions are posed on pages 25 and 26 of the appellate court decision (*Utahns for Better Transportation et al. v. U.S. Department of Transportation et al*. [305 F.3d 1152 (10th Cir. 2002)]).

of impacts of alternative sequences was presented to the CPIC in November 2003 to allow local, state, and federal agency and nongovernmental organization representatives to review and provide input.

Based on agency and public comments provided during the public scoping process for the Supplemental EIS, the lead agencies selected four sequencing scenarios that cover the reasonable range of alternative construction sequencing options.[2] Scenario 1 reevaluates the validity of the Final EIS findings that reconstructing I-15 prior to constructing Legacy Parkway is not a practicable alternative, and Scenarios 2, 3, and 4 evaluate the comparative impacts of constructing mass transit prior to, concurrent with, and after constructing Legacy Parkway. While the sequencing analysis uses the WFRC long-range plan for other inputs and information, the sequencing analysis substitutes "maximum future transit" (robust transit package B, described in detail in Section 2.3, *Integration*), which was developed for the integration analysis for the actual planned transit component of the WFRC long-range plan. Maximum future transit includes additional transit improvements to the transportation system above and beyond what is set forth in the 2020 timeframe of the 2030 WFRC long-range plan.

The lead agencies used the maximum future transit scenario to respond to scoping comments concerning whether increasing transit could affect the need for or the sequence of the construction of Legacy Parkway. Maximum future transit is used for sequencing and integration analysis purposes only in this Supplemental EIS; the transit enhancements assumed in the maximum future transit scenario would require the passage of ordinances, the support and action of local elected officials, and the reaction of the real estate market for actual implementation. Because such additional funding commitments are very uncertain, it is important to note that the sequencing and integration analyses may overestimate the share of travel demand that mass transit could carry during the study period.

Each of the four sequencing scenarios was analyzed for its relative impact on specific environmental and economic variables. These results were used to determine whether an alternative sequencing scenario would be a reasonable alternative requiring further evaluation in this Supplemental EIS.

2.4.2 Summary of Sequencing Analysis

The analysis conducted for the sequencing issues shows the following results.

- Constructing maximum future transit prior to building Legacy Parkway or reconstructing I-15 prior to building Legacy Parkway would delay the direct impacts on wetlands that would result from construction of Legacy Parkway for 3 to 7 years, respectively.

- Mass transit, even when analyzed with maximum future transit enhancements in place, does not alleviate the immediacy of the need for Legacy Parkway.

- Because of the high cost to the traveling public, it is not reasonable to delay construction of Legacy Parkway until all or part of maximum future transit is in place.

[2] Public comments were received requesting that additional alternatives be evaluated in the sequencing scenarios, including a Redwood Road expressway or a "robust" Redwood Road expanded arterial, similar to Bangerter Highway. These alternatives were evaluated and eliminated from detailed evaluation in this Supplemental EIS because they did not meet the purpose of and need for the project. The sequencing analysis focused on the other major components of the Shared Solution, which are part of all Legacy Parkway build alternatives that met the project purpose and need, not on all possible alternatives (such as varied alignment locations or configurations). See Chapter 3 for a detailed discussion of the evaluation of alternatives.

- Consistent with the Final EIS findings, it is not reasonable to reconstruct I-15 prior to building Legacy Parkway.

The analysis also shows that while direct impacts on wetlands would be delayed under Scenarios 1 and 2 (maximum future transit first), completing Legacy Parkway prior to reconstructing I-15 and prior to or concurrently with maximum future transit would have substantially lower costs to the traveling public, because there would be faster travel times, higher travel speeds, and improved level of service on I-15. In addition, completing Legacy Parkway prior to reconstructing I-15 and prior to or concurrently with maximum future transit would meet the project purpose and need by relieving traffic congestion on I-15 and providing an alternate north south route in the North Corridor.

The information described in the following sections is a summary of the technical analysis prepared for the sequencing technical memorandum used to reach these conclusions. Section 2.4.2.1, *Sequencing of the Shared Solution*, describes the approach to evaluating impacts of the four sequencing scenarios, and Section 2.4.2.2, *Results of Construction Sequencing Scenarios*, describes the results of the analysis.

2.4.2.1 Approach to Analysis of the Sequencing of the Shared Solution

The following four construction sequencing scenarios were developed for the Supplemental EIS analysis. Each scenario incorporates the three major components of the Shared Solution. As described above, Scenario 1 reevaluates the validity of the Final EIS findings that reconstructing I-15 prior to construction of Legacy Parkway is not a reasonable alternative, and Scenarios 2, 3, and 4 evaluate the comparative impacts of constructing maximum future transit prior to, concurrent with, or after Legacy Parkway construction. Comments were received from the cooperating agencies requesting that the sequencing analysis consider building maximum future transit and allowing time for transit facilities to function prior to undertaking Legacy Parkway construction or I-15 reconstruction. Although in reality the full range of transit-supportive changes would take up to 20 or more years to be fully implemented, the modeling assumptions for the sequencing analysis assume that transit-supportive changes, including seamless transfers, additional transit services, transit-oriented development, and denser populations within walking distance of transit, would be completed by the end of the construction period for maximum future transit. This demonstrates the highest level of transit mode share early and throughout the sequencing analysis time frame.

The four construction sequencing scenarios are as follows.

- Scenario 1.
  - Construct maximum future transit first.
  - Reconstruct I-15 second.
  - Construct Legacy Parkway third.
- Scenario 2.
  - Construct maximum future transit first.
  - Construct Legacy Parkway second.

  - Reconstruct I-15 third.

- Scenario 3.
  - Construct maximum future transit and Legacy Parkway concurrently.
  - Reconstruct I-15 last.
- Scenario 4.
  - Construct Legacy Parkway first.
  - Construct maximum future transit second.
  - Reconstruct I-15 third.

The scenarios cover the timeframe 2005 through 2015 and assume the continuous construction of transportation improvements. The sequencing analysis seeks to identify the order in which the elements of the Shared Solution should be constructed to reasonably minimize impacts during the construction period. The sequencing analysis assumes that, following a 3-year construction period, the first component of the Shared Solution becomes available for use in 2008 and that all three components are completed by 2014. The analysis accordingly assumes the impacts of all alternatives are the same before 2008 and after 2014 since the transportation system is the same before 2008 (all scenarios have no elements of the shared solution complete) and after 2014 (all scenarios have all elements of the shared solution complete). For each scenario, it was assumed that maximum future transit and Legacy Parkway would require approximately 3 years each to complete, and I-15 reconstruction would require 4 years to complete. For a construction schedule, see the sequencing technical memorandum, Volume 2 (HDR Engineering 2004b). Within this 10-year period, the analysis addresses three phases of project construction and operation: 2005 through 2007, 2008 though 2011/2012, and 2011/2012 through 2014. Two different traffic volume threshold years are included in the analysis (2007 and 2012) to account for the growth in travel demand in the 2005 to 2015 period. Comparison of the results for the interim years shows the relative effect of delaying or accelerating the construction of the various elements of the shared solution. Consistent with the Final EIS, the geographic area is bounded by the 1-15/I-215 interchange on the south and the US-89/I-15 interchange on the north. The following variables were used in evaluating the comparative impacts of the four scenarios. The rationale for selecting each of the variables is explained in detail in Section 3.4, *Description of the Analysis*, of the sequencing technical memorandum.

- Timing of direct impacts on wetlands.
- Costs to the traveling public.
- Travel speeds on I-15.
- Travel times on I-15, transit, and Legacy Parkway.
- Level of service on I-15 and Legacy Parkway.
- Capacity compared to demand on I-15, Legacy Parkway, and parallel arterials.
- Peak period energy usage under each scenario.

- Total peak-period air pollutants emitted under each scenario.
- Costs of construction under each scenario, expressed in 2003 dollars.
- Operating and maintenance costs.

After evaluating the impacts of constructing Legacy Parkway concurrent with and prior to maximum future transit (Scenarios 3 and 4, respectively), it was determined that the environmental impacts of the two scenarios were so similar that only one, Scenario 3, was necessary for performing the comparative analysis. Therefore, the sequencing analysis discusses the impacts of the following two comparisons.

- **Comparison of Scenarios 1 and 3.** The comparison of Scenarios 1 and 3 analyzes the impacts of reconstructing I-15 prior to constructing Legacy Parkway to determine whether maximum future transit would provide a sufficient level of congestion relief in the North Corridor to make it feasible to reconstruct I-15 before constructing Legacy Parkway.
- **Comparison of Scenarios 2 and 3.** The comparison of Scenarios 2 and 3 analyzes the relative impacts of constructing maximum future transit either before construction of Legacy Parkway or concurrently with construction of Legacy Parkway, when I-15 reconstruction occurs last in the sequence.

The results of the comparison of the impacts of these construction sequence scenarios are presented in the following section.

2.4.2.2 Results of Construction Sequencing Scenarios

In both scenario comparisons, the following variables showed the most significant difference in impacts.[3]

- Timing of direct impacts on wetlands associated with the construction of Legacy Parkway.
- Costs to the traveling public.
- Average travel speeds and travel times
- Level of service on I-15.[4]

Impacts associated with all scenarios for key variables are presented in Figures 2.4-1 through 2.4-4. A discussion of the results of comparing Scenario 3 with Scenarios 1 and 2 follows.

[3] Only key results for the variables with the most significant differences in impacts are presented in this section. For figures comparing all results for each of the four scenarios, as well as a detailed discussion of these results, see Sections 5.2 and 5.3 of the sequencing technical memorandum.
[4] Level of service on Legacy Parkway is not a key result with which to compare alternatives because under Scenarios 1 and 2, Legacy Parkway is not operational until 2015 and 2011, respectively.

Timing of Wetland Impacts

Wetland impacts were analyzed because wetlands are a resource of primary interest to the Corps under Section 404 of the Clean Water Act. For purposes of this analysis, delaying direct impacts on wetlands in the project right-of-way was assumed to be environmentally beneficial because delays would allow the wetlands to continue their existing functions until the project is constructed. For simplicity, this analysis assumes that none of the impacts on wetlands and none of the mitigation associated with Legacy Parkway have occurred. Existing wetlands functions include wildlife use, flood storage benefits, and water quality benefits. (See Section 4.12, *Wetlands*, for a description of wetland functions in the study area).

The direct wetland impacts estimated for each component of the Shared Solution (Legacy Parkway, reconstruction of I-15, maximum future transit) represent the estimated amount of wetlands within the project right-of-way as reported in the studies conducted for this Supplemental EIS, the I-15 North Corridor draft EIS (Federal Highway Administration and Utah Department of Transportation 1998), and the commuter rail final EIS (Federal Transit Administration and Utah Transportation Authority 2005). For this analysis, it was assumed that physical impacts on all the wetlands within the right-of-way would occur during the first year of a project's construction. There is insufficient information on the BRT component of maximum future transit from which to determine all wetland impacts of maximum future transit. However, the direct wetland impacts associated with the BRT component are likely to be minor, and wetland impacts associated with maximum future transit would not change significantly from the estimate in the commuter rail final EIS (Federal Transit Administration and Utah Transit Authority 2005).

Compared to Scenario 3, Scenario 1 would have a net delay of 46 ha (113 ac)[5] of wetland impacts for 3 years and a net delay of 40 ha (98 ac) for an additional 4 years. Compared to Scenario 3, Scenario 2 would have a net delay of 46 ha (113 ac) for 3 years. This means that although the total direct impacts on wetlands from all the components of the Shared Solution would be the same under all scenarios (7.2 ha [18 ac] for maximum future transit, 6.1 ha [15 ac] for I-15 reconstruction, and 46 ha [113 ac] for Legacy Parkway) for a total of 59 ha [146 ac], the wetlands in the Legacy Parkway right-of-way would continue their existing functions until commencement of Legacy Parkway construction. For Scenario 1, this would be in 2012, and for Scenario 2, this would be in 2008. There would still be 7.2 ha (18 ac) of wetlands impact in 2005 under both Scenarios 1 and 2 resulting from construction of maximum future transit and an additional 6.1 ha (15 ac) under Scenario 1 in 2012 resulting from the reconstruction of I-15. (See direct impacts on wetlands associated with each scenario in Figure 2.4-1.)

Costs to the Traveling Public and Average Travel Speeds and Times on I-15

Costs to the traveling public were analyzed for each scenario because they directly reflect the efficiency of travel (travel speeds and travel times). For this analysis, the costs to the traveling public for I-15 and Legacy Parkway are assumed to consist of the value of time spent traveling through the corridor and the cost of energy (fuel) used to accomplish this. The value of travel time during the peak period was estimated by multiplying the time it takes to travel through the corridor by the volume of traffic (or transit ridership) and by the value of the travelers' time, expressed in dollars per hour. For the cost of energy

[5] The 46-ha (113-ac) figure refers to the acreage of wetlands located within the Alternative E right-of-way in this Supplemental EIS, which was used for this sequencing analysis. However, the design of interchanges and design flexibility used for the actual footprint of the roadway facility within the right-of-way could result in fewer actual acres of wetlands lost to direct impacts. See Section 2.1, *Right-of-Way Issues*, for a detailed discussion of wetlands impacts for each alternative.

usage, a representative dollars-per-gallon[6] value of fuel was multiplied by the energy usage estimate. In the case of maximum future transit, the cost was assumed to be the value of time spent traveling through the corridor plus the cost of fares. Because the fares assumed for maximum future transit were reduced relative to UTA's current policy of charging premium fares for premium service, actual transit user cost is likely to be higher than indicated in this analysis.

The main difference between Scenarios 1 and 3 with respect to average speeds and travel time is that average speeds on I-15 are 80 kph (50 mph) faster under Scenario 3 than under Scenario 1 from 2008 through 2010, and 74 kph (46 mph) faster in 2011, and average travel times on I-15 range from 35 to more than 45 minutes slower in the evening peak hour under Scenario 1 than under Scenario 3 from 2008 through 2011. This is because maximum future transit does not provide sufficient congestion relief on I-15 when I-15 is being reconstructed (with no Legacy Parkway in place).

The main difference between Scenarios 2 and 3 with respect to average speeds and travel times is that average speeds on I-15 are over 31 kph (19 mph) faster under Scenario 3 than under Scenario 2 in the years 2008 and 2009, and 47 kph (29 mph) faster in 2010 and average travel times on I-15 are 5 minutes slower in 2008 and 2009, and 10 minutes slower in 2010 under Scenario 2 than under Scenario 3. This reflects the impact of delaying the construction of Legacy Parkway. During this 3-year delay, congestion on I-15 would increase at a rate exceeding the service provided by maximum future transit.

These longer travel times and slower average speeds associated with Scenarios 1 and 2 would result in higher costs to the traveling public. (See average travel speeds and travel times associated with all scenarios presented in Figures 2.4-2 and 2.4-3.) Under Scenarios 1 and 2, there would be approximately $249 million and $24 million in additional costs to the public for the evening peak period, respectively, compared to Scenario 3. With the inclusion of the morning peak period, the cost doubles to an additional $500 million and $48 million, respectively, compared to Scenario 3. (Costs to the traveling public associated with all scenarios are presented in Figure 2.4-4.)

Low travel speeds on I-15 under Scenario 1 from 2008 through 2011 also indirectly indicate changes in roadway safety. The very low speeds (10 to 13 miles per hour) and greater levels of congestion on I-15 will divert more traffic to the arterial streets. According to UDOT traffic accident statistics for large urban areas, arterials experience about four times the accident rates and similar degrees of accident severity as freeways at the same traffic volume.

Summary of Results for Scenario 1 Compared to Scenario 3

The comparison of Scenario 1 to Scenario 3 indicated that each scenario would result in certain benefits over the other, as described below.

- Benefits under Scenario 1 (maximum future transit first, I-15 reconstruction second, Legacy Parkway third).
  - Net delays of impacts on 46 ha (113 ac) of wetlands for 3 years and a net delay of 40 ha (98 ac) of wetlands impacts for an additional 4 years.

[6] The average price of gasoline and diesel used in the analysis is $1.58 and $1.64 per gallon, respectively. This was the average price on November 11 and 17, 2003, as provided by the American Automobile Association (AAA). Gasoline prices can fluctuate, and have risen in 2004 and 2005, but the 2003 costs remain reflective of long-term historic prices. Higher or lower gasoline prices would raise or lower an element of the costs to the traveling public.

- Provides a more efficient commute through the North Corridor from 2012 to 2015 by improving travel speeds from about 28 mph under Scenario 3 to about 49 mph for Scenario 1 for the 3-year period

- Benefits under Scenario 3 (construction of Legacy Parkway concurrently or prior to maximum future transit).

  - Saves approximately $249 million in costs to the traveling public for the evening peak period ($403 million in costs to the traveling public for the evening peak period under Scenario 3 compared to $652 million under Scenario 1). Saves approximately $498 million when considering travel during both the morning and evening peak periods.

  - Provides faster travel speeds through the North Corridor by about 50 mph (from 10–13 mph to about 60 mph) for the 4-year period from 2008 to 2011.

  - Reduces travel times through the North Corridor by about 35 minutes for the 4-year period from 2008 to 2011.

  - Provides for a safer and less stressful commute through the North Corridor for the 4-year period from 2008 to 2011, by reducing likelihood that through traffic would divert to local-access serving arterial streets.

Summary of Results for Scenario 2 Compared to Scenario 3

The comparison of Scenario 2 to Scenario 3 indicated that each scenario would result in certain benefits over the other.

- Benefits under Scenario 2 (maximum future transit first, Legacy Parkway second, I-15 reconstruction third).

  - Delays impacts on 46 ha (113 ac) of wetlands for 3 years.

- Benefits under Scenario 3 (concurrent construction of maximum future transit and Legacy Parkway, I-15 reconstruction last).

  - Saves approximately $24 million in costs to the traveling public for the evening peak period ($403 million in costs to the traveling public for the evening peak period under Scenario 3 compared to $427 million under Scenario 2). Saves approximately $48 million when considering travel during both the morning and evening peak periods.

  - Provides faster travel speeds through the North Corridor by about 40 kph (25 mph) for the period from 2008 to 2011.

  - Reduces travel times through the North Corridor by 5 to 10 minutes for the period from 2008 to 2011.

  - Provides for a safer and less stressful commute through the North Corridor by reducing likelihood that through traffic would divert to local-access serving arterial streets from 2008 to 2011.

2.4.3 Conclusions

The sequencing scenarios selected for analysis address the full range of alternative construction sequencing of major components of the Shared Solution and respond directly to the questions posed by the court and stated above in Section 2.4.1.

The results of this sequencing analysis with regard to those questions are as follows.

- Maximum future transit does not alleviate the immediacy of need for Legacy Parkway or I-15. It is not reasonable to delay construction of Legacy Parkway until all or part of maximum future transit is in place.

- Consistent with the findings in the Final EIS, it is not reasonable to reconstruct I-15 prior to building Legacy Parkway.

Delaying Legacy Parkway construction is not reasonable because doing so would incur additional costs to the traveling public of between $48 million and $498 million (combined morning and evening peak period loss of time and energy cost). The $48 million additional cost results from delaying Legacy Parkway until maximum transit improvements are completed, but still building Legacy before reconstructing I-15. The $498 million additional cost results from delaying Legacy until after I-15, so that I-15 reconstruction is done without the benefit of an alternate route for freeway traffic. Additional impacts associated with delaying construction of one or both highway projects include increased congestion delays and increased diversion of long-distance traffic and trucks to local streets resulting in potential for increases in accidents.

The results of the analysis of Scenarios 1 and 2 also show that maximum future transit would not reduce the immediacy of the need for Legacy Parkway because travel demand exceeds capacity in both scenarios. Comments received during the public scoping period requested that the Supplemental EIS determine whether constructing mass transit and reconstructing I-15 would meet travel demand such that Legacy Parkway would not be necessary. The results of Scenario 1 illustrate that mass transit and I-15 reconstruction alone would not meet travel demand. All components of the Shared Solution are needed to meet the travel demand. Even with maximum future transit implemented by 2008, delaying construction of Legacy Parkway (Scenario 2) would fail to meet demand from 2005 to 2015. Delaying Legacy further so that maximum future transit provides the only corridor-length alternative to I-15 during its reconstruction (Scenario 1) would substantially fail to meet demand during the I-15 reconstruction period, 2008 to 2012.

Comparing Scenarios 3 and 4, which sequence Legacy Parkway construction prior to reconstruction of I-15, to Scenario 1 demonstrates that it is more reasonable to build Legacy Parkway before the reconstruction of I-15 because I-15 would experience extreme congestion without Legacy Parkway to absorb the displaced traffic during the reconstruction. This extreme congestion is reflected in the cost to the traveling public, level of service failure, substantially slower travel speeds, and greater travel times of Scenario 1 compared to Scenarios 3 and 4. Both Scenarios 3 and 4 support the project objective of minimizing the amount of corridor through traffic that diverts from I-15 onto local streets by providing an alternative north-south route during I-15 reconstruction. Scenarios 3 and 4 indicate that there is no significant travel time savings gained by sequencing maximum future transit before Legacy Parkway and no negative impacts on travel time of building maximum future transit concurrently with Legacy Parkway. This supplemental EIS incorporates the following findings of the sequencing analysis.

- Constructing maximum future transit prior to building Legacy Parkway, and reconstructing I-15 prior to building Legacy Parkway would delay the direct impacts on wetlands that would result from construction of Legacy Parkway for 3 to 7 years, respectively.

- Mass transit, even when analyzed with maximum future transit assumptions in place, does not alleviate the immediacy of the need for Legacy Parkway.

- Because of the high cost to the traveling public, it is not reasonable to delay construction of Legacy Parkway until all or part of maximum future transit is in place.

- Implementation of either Scenario 3 or Scenario 4 would meet the project purpose and need for an alternate route 3–4 years earlier.